10.—FOSSIL PLANTS FROM GINGIN, W.A.

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(Plates I.-II.)

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Abstract.

Fossil plants described from Gingin indicate a Jurassic Age for beds of clayey sandstone underlying the Cretaceous greensands. The collection includes specimens of leaves and sporangia referred to *Isoetites*, the first record of this genus for Australia.

The collection of fossil plants here described was forwarded to me by Professor E. de C. Clarke in 1937. It is regretted that circumstances have so long delayed the completion of my investigations.

The specimens were obtained from brownish, fine-grained, clayey sandstones underlying the Cretaceous greensands at Gingin, W.A., and the list of species lends support to Professor Clarke's statement, in a letter, that he had "fairly good evidence that the chalk and greensand lie on an eroded surface of the plant beds."

The species identified are:—

Isoetites elegans, sp. nov.
Cladophlebis australis (Morris).
Thinnfeldia talbragarensis Walkom.
Taeniopteris spatulata McClelland.
Ptilophyllum pecten (Phillips).
Elatocladus plana (Feistmantel).

They suggest a Jurassic age for the beds in which they occur, and show closest similarities with the Jurassic flora of the Talbragar Beds in New South Wales.

Perhaps the most interesting feature is the presence of numerous specimens referred to *Isoetites*. Fossil representatives of this group are few in number, and none appear to have been described from rocks of Jurassic age, so the species *I. elegans* may be the earliest species yet known, as well as being the first fossil species known from Australia. The genus *Isoetes* has a wide range at the present day but only six species appear to be recorded from Australia (three from Tasmania, and one each from Queensland, South Australia, and Western Australia).

Professor Clarke has suggested that these plant-bearing beds at Gingin may be the continuation of plant beds at Bullsbrook, some 30 miles north of Perth. In 1931 I examined for him a collection of fragmentary plant remains from the Bullsbrook beds and determined the following species:—*Cladophlebis australis*, ? *Phyllopteris* sp., *Thinnfeldia* sp., *Taeniopteris elongata*, *Nilssonia* sp., and *Elatocladus* cf. *plana*. This small collection was not very satisfactory for determination of the age of the beds and at the time I suggested that possibly a Lower Cretaceous age was indicated. As a whole the Bullsbrook collection does not show close affinities with that from Gingin, and may represent a somewhat higher horizon.

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LYCOPODIALES.

Isoetites elegans, sp. nov.

(Plate I.)

Leaves numerous, long (up to 12 cm. or more), straight or slightly curved, about 3–4 mm. wide at base, tapering to apex, with very fine parallel striations. Sporangia usually 1·5–2 cm. long, by 7–8 mm. Megaspores spherical, about 0·5 mm. in diameter, smooth, with equatorial ridge, and tri-radiate marking on one hemisphere, 40–55 megaspores in a sporangium.

In the specimen figured (Plate I., fig. 1) there are some 36 leaves visible ; in addition the bases of a number of other leaves can be observed on the vertical edge of the specimen, so the total number of leaves is greater than 36. The leaves are all simple and there is no indication of dividing as occurs in *Baiera* and allied genera. The tapering of the leaf is very gradual—from 3–4 mm. wide at base to 1 mm. wide at a distance of 12 cm. from the base.

The sporangia vary little in shape, but they may be divided into two distinct groups—one in which the individual megaspores are clearly visible, the other in which little or no structure can be observed (see Plate I., fig. 2). There is some indication in a few of the latter type that the sporangia contain megaspores, outlines of which can be observed. It may be, however, that the majority of these sporangia which show no structure now were the microsporangia and that no details of the microspores are preserved in the specimens available.

The megaspores (Plate I., figs 4, 5), with their equatorial ridge and the tri-radiate marking on the upper half, are of the type characteristic of *Isoetes* and, from the association of the sporangia with the specimen in which the leaves are so similar to those of species of *Isoetes*, it is reasonable to conclude that sporangia and leaves belonged to the one species and to refer them to the genus *Isoetites*. There is indeed evidence that the sporangia occupied the position usual in *Isoetes*, several specimens, of which one is figured (Plate I., fig. 3), showing a sporangium resting on the wide basal portion of a leaf.

Some specimens, such as that figured on Plate I., fig. 2, show a number of sporangia (megasporangia and ? microsporangia) arranged more or less parallel to one another. Some of those on the figured specimen have some indication that they rest on portions of leaves.

In size and shape these fossil sporangia are well within the range of those of recent species of *Isoetes*, as also are the megaspores. The range of size of megaspores in recent species is from 250 to 900 μ. Such species as *Isoetes Engelmanni* and *I. Boryana* would bear comparison with our fossils in this respect (see Pfeiffer, 1922).

There are few recorded fossils that can with certainty be referred to *Isoetites*, so that comparison of the Western Australian specimens with known species is restricted. The leaves are very different from those of *I. serratus* and *I. horridus* from Cretaceous rocks in Wyoming, U.S.A. (Brown, 1939, p. 268) and no details of the megaspores are known in these two species.

The fossils described as *Isoetites Choffati* Saporta from the Lower Cretaceous of Portugal are not comparable with our specimens, since they consist of small tuberous bodies compared with the stem of *Isoetes*, and impressions identified as the basal portions of sporophylls bearing sporangia (*fide* Seward, 1910, p. 67—a copy of Saporta's original description does not appear to be available in Australia).

Type specimens in collection of Geology Department, University of Western Australia: Nos. 16687 (leaves) and 16683 (sporangia). Counterparts of portions of the types are in the collection of the Australian Museum (Nos. F 39818, F 39816).

FILICALES.

Cladophlebis australis (Morris).

There are one or two specimens referable to *Cladophlebis australis*. They are not well preserved and apparently the species is not at all abundant.

Thinnfeldia talbragarensis Walkom.

(Plate II., fig. 8.)

Several specimens agree well with *Thinnfeldia talbragarensis* from Jurassic rocks at Talbragar, N.S.W. (Walkom, 1921, p. 9).

The frond is bipinnate and of the type common in Australian Thinnfeldias but there is no indication that the rachis divides dichotomously as it does in most Australian species of *Thinnfeldia*.

Sphenopterid fragments.

Several sphenopterid fragments, which show no detail, may belong to a species such as *Coniopteris hymenophylloides* which is common in Jurassic floras, and is known in association with *Taeniopteris spatulata* in the Australian Jurassic.

Taeniopteris spatulata McClelland.

(Plate II., fig. 9.)

There is a considerable variety of leaves in the collection referable to *Taeniopteris*, examination of which only emphasizes the difficulty of accurate specific definition of numerous sterile *Taeniopteris* fronds (see Seward, 1904, p. 169).

These leaves are elongate lanceolate, somewhat strap-shaped, more than 7 cm. long, usually up to 1·6 cm. wide, occasionally somewhat wider (2·4 cm.), with a prominent finely-striated midrib which has a width of 1·5 to 2 mm. The secondary veins are at right angles, or almost so, to the midrib; many of them are simple, but many divide, usually only once, at varying distances from the midrib; on the average there are about 16 veins per cm. of lamina, but the number varies considerably, and in some of the narrower leaves there may be as many as 25 or 30 veins per cm.

It is not easy to separate these fronds from *T. spatulata* McClelland, and *T. spatulata* var. *major* (Seward). The larger specimens certainly approach *T. Carruthersi* Tenison-Woods, a species which has never been very satisfactorily described, since only incomplete specimens have been available. The midrib in the Western Australian specimens appears to be much more prominent than that of *T. Carruthersi*.

T. spatulata occurs abundantly in the Jurassic rocks of Eastern Australia, and occasionally in the Cretaceous. *T. Carruthersi*, on the other hand, appears to be a somewhat older form, occurring in the Triassic (Ipswich Series) of Eastern Australia, and in the Stormberg Beds of South Africa.

CYCADALES.

Ptilophyllum pecten (Phillips).

(Plate II., fig. 6.)

Specimens referred to *Ptilophyllum pecten* are quite similar to the many figured examples of this species which is widely distributed in rocks of Jurassic age. They are preserved as impressions on a fine-grained, ferruginous micaceous sandstone, and are not likely to furnish any details of cuticular structure. It therefore seems only possible to refer them to *P. pecten* (see Seward, 1917, p. 524). In Eastern Australia this species occurs in the Jurassic rocks at Stewart's Creek, Stanwell, Queensland, and in the Cretaceous rocks of the Maryborough Series and the Burrum Series.

CONIFERALES.

Elatocladus plana (Feistmantel).

(Plate II., fig. 7.)

Several specimens may be referred to *Elatocladus plana* Feistmantel, a common Jurassic type, of which Seward (1919, p. 431) has figured two specimens. The species has also been figured from Jurassic and Cretaceous rocks in Queensland (Walkom, 1917, Pl. 9, fig. 4 ; 1919, Pl. 2, figs. 4, 5).

The Western Australian specimens have linear leaves about 1·5 cm. long, with a distinct midrib.

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EXPLANATION OF PLATES.

Plate I.

Isoetites elegans, n. sp.

Fig. 1. *Isoetites elegans*, n. sp. Specimen No. 16687. ×½.

Fig. 2. Group of sporangia. Specimen No. 16683. ×3.

Fig. 3. Sporangium in position on basal portion of a leaf. Specimen No. 16682. ×¾.

Fig. 4. Single sporangium. Specimen No. 16711. ×½.

Fig. 5. Portion of figure 4 enlarged to show triradiate ridges on megaspores. ×14.

1

2

3

4

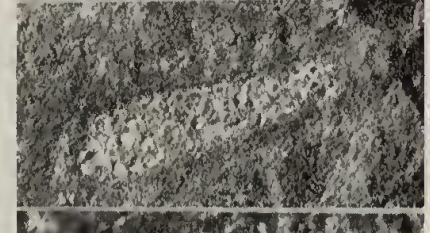

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PLATE 1.

Plate II.

Fig. 6. *Ptilophyllum pecten* (Phillips). Specimen No. 16684. ×1.
Fig. 7. *Elatocladus plana* (Feistmantel). Specimen No. 16703. ×1.
Fig. 8. *Thinnfeldia talbragarensis* Walkom. Specimen No. 16690. ×¾.
Fig. 9. *Taeniopteris spatulata* McClelland. Specimen No. 16685. ×1.

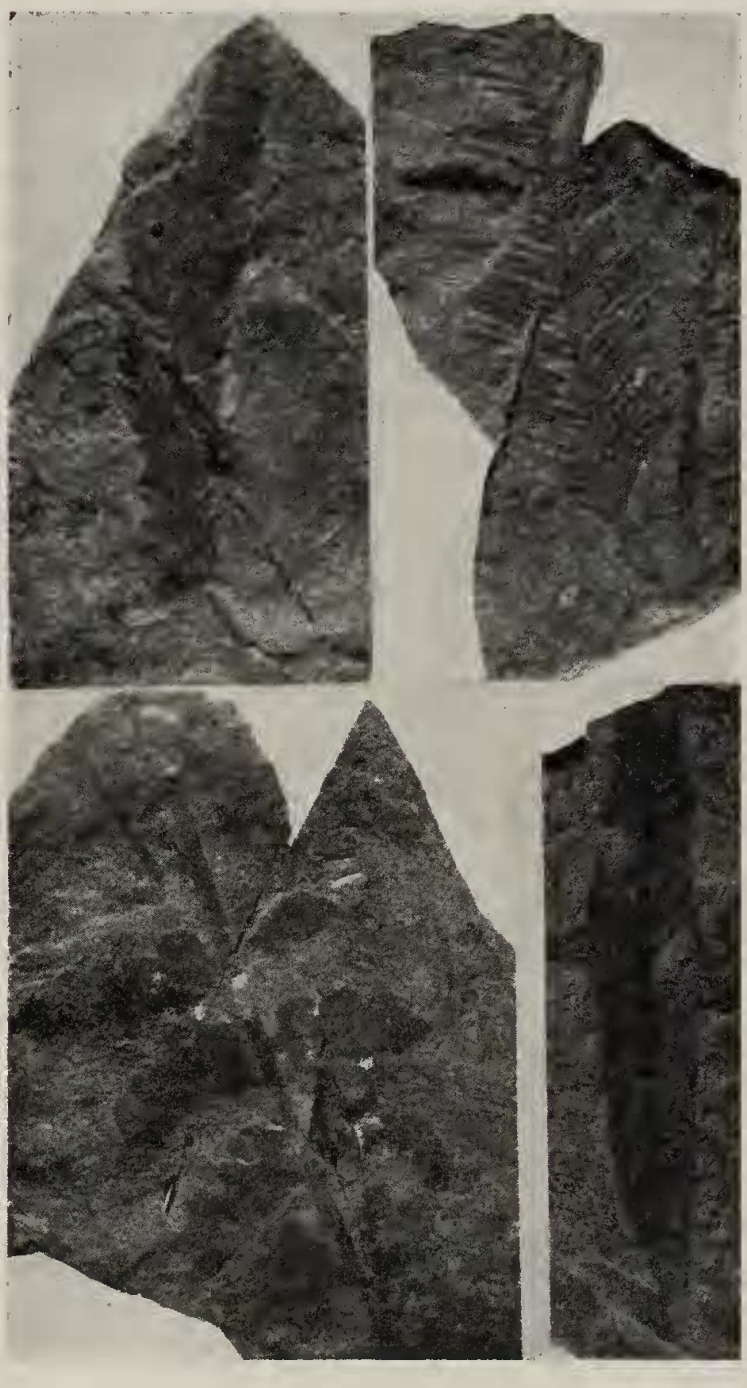

PLATE II.